

THE POPULATION ESTIMATES PROGRAM
of the
Colorado Division of Local Government

June, 2003

The Demography Section of the Colorado Division of Local Government (CDLG) annually prepares estimates¹ of the current population of all counties, municipalities, and special districts eligible for Conservation Trust Fund (lottery) monies. These estimates are also used for a wide range of purposes including planning and evaluation, and the assignment or distribution of projects and/or monies, by public and private agencies parties. In addition, they become the bases for revisions of population projections and forecasts, in particular, those prepared by the Demography Section.

How the Estimates Are Prepared

The estimates are prepared by statistical techniques in three distinct phases: The first phase is the preparation of an estimate for the state as a whole, the second is that for each of the 64 counties, and the third is for the 270 municipalities and then the 105 special districts that receive money from the Conservation Trust Fund. The following provides a general description of each of these phases:

1. The State Population Estimate. The state population estimate is initially based on an estimate prepared by the U. S. Bureau of the Census and released in the last week of December of that year. (The July 1, 2002 estimate was released on December 30, 2002; the July 1, 2003 estimate will be released on December 30, 2003.) The Census Bureau's 2002 estimate is based on administrative records, namely data available to it from other Federal and state agencies. The Demography Section's state estimate at that time is equal to its own state estimate from the previous year plus the amount change estimated by the Census Bureau in its December release.

To prepare its estimates, the Census Bureau separately estimates the "natural increase" and the migration components of population change. Natural increase is determined on the basis of the number of resident births and deaths. Migration is estimated from data on "movers" in the Internal Revenue Service (IRS) tax records², from data on immigration from the Immigration and Naturalization Service (INS), and from an interpretation of changes in Medicare enrollments³.

¹ As demographers use the term, an estimate is a determination or approximation of the "current" population of a particular area. By current is meant that of a most recent year or time period. It differs from a projection or forecast of the population for that year in that it is based on data -- usually collected for other purposes -- of actual events that occurred during the year such as births, deaths, school enrollment, and employment. It is prepared in lieu of an actual count or census which is very expensive, but understandably an estimate does not have the accuracy of a census.

² "Movers" are estimated on the basis of the number of exemptions that were reported from a different location in the current year than from where they filed the previous year.

³ These Medicare enrollment data are compiled by the Health Care Financing Administration in the Department of Health and Human Services.

A number of factors suggest a certain amount of error (probably several percentage points) in the Census Bureau's prepared state estimates. First, as they attempt to estimate change since the 2000 Census, they retain whatever error of undercount or overcount resulted from the Census. (It has been estimated that Colorado's population was undercounted by 1.2% in 2000; that of the entire U. S. is believed to be 1.6%.) Second, birth and death data are incomplete at the time the estimates are prepared and are only fully accounted for in the revised estimates the following year. Third, a significant portion of the addresses contained in the IRS and Medicare enrollment data are not the filer's actual residences. Thus, if there are any significant changes in the patterns of where people live versus where they file their income tax, the data will be misinterpreted in preparing the estimate. Finally, while the initial residences of legal immigrants are known, it is likely that some of their internal (within the country) migrations are missed. Needless to say, the residences of illegal or undocumented immigrants within the country are known even less.

Nonetheless, because of the objectivity of the Census Bureau's state estimates and the fact that they are based on valuable data that are not available to the state's themselves, its estimate of the population change in Colorado is used as the initial state estimate for that year.

2. The County Estimates. The county estimates that are used and disseminated by the Demography Section are not those prepared by the Census Bureau. In general, however, they are very similar in that the basic methods that they use are the same and the estimates of the most important variable - net migration - are also the same. The Demography Section's estimates differ from those of the Census Bureau, first, because the data that they use for the other components of change -- births, deaths, and change in group quarters population -- are more up-to-date. They differ also because the Section has made some adjustments or corrections to the Census Bureau data on net migration where it has been evident that the Census Bureau's estimate were in error. These mostly upward adjustments, in themselves, have resulted in an approximately 0.4% difference between the Section's estimate of the state's total population, which is the sum of its estimates for all the counties, and the Census Bureau's state population total.

The Demography Section's and the Census Bureau's method of preparing county estimates is the same "component (of change) method used by the Census Bureau to prepare the state estimate. Starting with the previous year's estimate, a "natural increase" is determined on the basis of resident births and deaths, and migration is estimated from the administrative records in the manner described above. The Demography Section variation on this method is to start with a different 2000 estimate (its own) as its basis since this accounts for adjustments it has made to the Census Bureau's count. A "natural increase" (or decrease) is then added (or subtracted) based on the most current data for births and deaths. Similarly, any changes in the populations of group quarters, based on the Section's most current information, are added or subtracted from the 2000 base estimate. Finally, the Census Bureau's estimate of net migration is added to produce the 2000 estimate (by this method). As the most important variable in this process is usually the net migration, the results of this method produce a percent change that is nearly identical to the Census Bureau's estimate.

While the limitations of this method, described above in regards to the state estimate, apply even more so at the county level, it is felt that in general the county estimates that are based on the Census Bureau's estimate of net migration are the best starting point for the Colorado Demography Section's

determination of its county estimates. This is (so felt) because the administrative records which the Census Bureau has access to (and other demographers do not) best track the actual movements -- or presence -- of populations better than any other available data. However, because these limitations can be significant in some cases, the estimates based on the Census Bureau's estimate of net migration are reviewed and evaluated against the results of two estimates models developed by the Demography Section that have been used in the past to prepare the estimates.

The first is a cross-section regression model that is calibrated on the basis of 2000 data and that uses births, deaths, and school enrollment to estimate the current population. The birth and death data that are used are obtained from the Health Statistics Section of the Colorado Department of Public Health and Environment. The data used in the estimates are moving averages involving two or three years.⁴ School enrollment data are obtained from the Colorado Department of Education and include that of private schools and home study. Only grades 1 through 8 are used in estimating the population as the dropout rates for the higher grades can vary over time. Special work is required to prepare these data by county as 61 of 180 school districts in the state cross county boundaries.

The second model estimates **percent change** in a county's population since 2001 on the basis of a weighted average of percent changes (standardized at the state level to the percent change in population) in school enrollment (representing all children), wage and salary employment (representing the population 18 - 64), and Medicare enrollment (representing population 65 and over). The concept that lies behind this evaluation model is that the percent change in the overall population should lie somewhere in the middle of that of these three variables. The model was developed to include the consideration of employment in the estimates process to insure representation of the working age population (18 to 64) which is currently nearly 65% of the total population and because of its strength as an indicator of population change.

In general, the final estimates are very similar to the Census Bureau's estimates. The differences are due to the abovementioned (generally upward) adjustments where the Census Bureau missed certain population and to any adjustments the Demography staff felt were appropriate based on results of their models.

After staff has prepared its first version of the county estimates, the numbers are sent out to professional staff in the state's regional councils of government for their review and comment. The estimates are presented to them on a table which includes the Census Bureau's estimate and data on births, deaths, school enrollment, and employment (see Table 1, page 4). After their comments have been received and taken into account, the county estimates are labeled as "**draft**" estimates for use in the next stage of the process.

⁴ The revised data for previous years, e.g., 2000, is 50% times the data for current year (2000 and 25% times the data for each of the neighboring years (1999 and 2001). The data used for the current year is 67% times the data for that year (2001) and 33% times that for the previous year (2000).

Table 1. CTF Colorado County Population Estimates Review (Summer, 2003)

Adams

	A	B	C	D	E	F	G
	Census Count April 1, 2000	Adjusted April 2000	Pop. Estimate July 1, 2000	Pop. Estimate July 1, 2001	Natural Incr. 7/1/01 - 6/30/02	Net Migration 7/1/01 - 6/30/02	Pop. Estimate July 1, 2002
Colo. Demog.	363,857	347,987	350,642	361,262	4,057	7,551	372,870
<i>Amt. Change</i>				10,620			11,608
<i>% Change</i>				3.03%			3.21%
U.S. Census	363,857	347,987	351,245	361,458	3,948	8,693	374,099
<i>Amt Change</i>				10,213			12,641
<i>% Change</i>				2.91%			3.50%
Difference	0		-603	-196	109	-1,142	-1,229
<i>Demog-USCB</i>							

Symptomatic Data

<u>Schl. Enroll.</u>	Oct. 2000	Oct. 2001	Oct. 2002	00-01 %Chg	01-02 %Chg	<u>Housing Units</u>	July 1, 2000	July 1, 2001	July 1, 2002	00-01 %Chg	01-02 %Chg
	42,132	43,217	44,826	2.6%	3.7%		133,630	139,364	138,733	4.3%	-0.5%
<u>W and S Jobs</u>	2nd & 3rd Qtr: 2000	2nd & 3rd Qtr: 2001	2nd & 3rd Qtr: 2002	00-01 %Chg	01-02 %Chg	<u>Births</u>	Jly '99-Jun '00	Jly '00-Jun '01	Jly '01-Jun '02	00-01 %Chg	01-02 %Chg
	146,275	147,831	145,909	1.1%	-1.3%		5,809	5,904	6,145	1.6%	4.1%
						<u>Deaths</u>	Jly '99-Jun '00	Jly '00-Jun '01	Jly '01-Jun '02	00-01 %Chg	01-02 %Chg
							1,992	2,069	2,088	3.9%	0.9%

3. The Sub-County Population Estimates.

The sub-county population estimates are initially prepared on the basis of existing housing units. More specifically, the county estimate of the total population developed above is shared proportionally to the sub-county areas on the bases of the number of their housing units. Thus, it is critical to the estimates process to identify as best as possible the number of housing units for each sub-area.

Preparation of housing unit data by sub-county area.

There are two categories of procedures that are involved with the determination of the number of housing units in each sub-area. The first is in determining the number of housing units that were counted in the 2000 Census; the second is in determining the number of new housing units that have been added to each sub-area since the 2000 Census.

The first, determining the number of housing units that "existed" or were counted in the 2000 Census by sub-area, would have to be performed only once a decade if it were not for sub-area boundary changes. However, because such boundary changes do occur, in each instance, a determination has to be made as to its effect on the number of base-year (2000) housing units in each sub-area. Thus, if a municipality annexed new lands, it is necessary to determine first the number of housing units that existed in this area in 2000 and add them to the municipality and subtract them from the unincorporated part of the county. Similarly, if a new park and recreation district came into existence since the previous year and/or one changed its boundaries, then the number of housing units that existed in these affected areas in 2000 would have to be recalculated or reassigned.⁵

The second category of steps for determining the number of housing units by sub-area is concerned with defining the number of new (completed since 2000) housing units for each sub-area. The first step of this process is the compilation of data on building permits reported to and made available by the U. S. Bureau of the Census by building permit place which are, in general, municipalities or groups of municipalities. A second step is that of uncovering information on new housing units from other sources (such as from mobile home permits or septic tank permits) in areas that do not require building permits. Lag times are assumed in the cases of these permits to account for the time between when the permit was issued and the unit was occupied. In some instances, certificates of occupancy are used to establish the number of newly occupied units. Finally, an attempt must be made to determine the number of new housing units by special district.

The Demography Section is dependent on local sources to obtain this information, i.e., the number of new houses in unreported municipalities and in special districts. It relies on county or city planning agencies or building departments for this data. In lieu of obtaining this information, the

⁵ In the past, these calculations were performed only in cases where there were new park and recreations (CTF) districts or where staff was notified by a municipality of a significant annexation. Boundary changes that have resulted from municipal annexations are now being recorded by the Cartography Section (of the Colorado Division of Local Government) and their 2000 base data added to the process of determining their current year estimate.

new housing units of the larger area are assigned to the smaller areas in proportion to the known existing housing. When this proportional assignment leads to significant error, the staff are usually quickly notified by the effected community.

Calculation of the Draft Population Estimates for Sub-County Areas
Based on the Number of Existing Housing Units.

Once the number of housing units has been "determined" or assigned for each sub-county area, an initial set of population estimates is calculated. This is essentially based on each sub-areas ratio of population- to-housing units for the previous year and scaled to any change in that ratio at the county level brought about by the new county population estimate and the new county total of housing units. These calculations are shown on Table 2A (upper panel) on page 7.

On this table, the previous year's data are presented in columns C - E. Column F lists the new housing units for each sub-county area, which when added to the previous year's inventory (column D) produces a current year total of housing units. The new county population and the new county total of housing units produce a new **county** ratio of population-to-housing units. This may be a certain percentage higher (or lower) than that in the previous year (column E, top number). Thus, the population-to-housing units ratios for each sub-county area are increased (or decreased) by that percentage. These new (current year) ratios for each sub-county area (column H) are then multiplied by the new number of housing units (column G) to calculate the (initial) current year population estimates for each sub-county area (column I'). They are then scaled to add to the previously-determined county total (column I). Finally, they are adjusted were there has been a new annexation to obtain new totals (columns J=I+K for population and Q=G+L for housing units).

After the initial population has been calculated, a series of other calculations are performed to permit the evaluation of these results against perceived occupancy rates (see Table 2B, lower panel). First, the number of people in group quarters (column N) is subtracted from the total population (column M) to give **household population** (column O). Then, on the basis of national trends in household size (column P), the sub-area's household size from the previous year is adjusted (to decline slightly, if at all) and divided into the household population (column O) to calculate an implied number of **households** which is the same as the number of **occupied housing units** (column R). These (occupied housing units) subtracted from total housing units (column Q) equals the number of **vacant housing units** (column S) which when divided by the total housing units gives a **vacancy rate** (column T). The perceptions developed from these calculations provide an additional basis for the review of the estimates.

Table 2A. Draft Municipal Population and Housing Estimates, July 1, 2002 (For Review)

ADAMS COUNTY

Name of Municipality	A	B	C	D	E=C/D	F	G=D+F	H	I=GxH	J
	April 1, 2000 U.S. Census Bureau Ti. Pop.	April 1, 2000 U.S. Census Bureau Ti. H.U.	July 1, 2001 as Adjusted by the Colo. Demog. Section Ti. Pop.	July 1, 2001 as Adjusted by the Colo. Demog. Section Ti. H.U.	Pop/HU	New H.U. Hsg Units	July 1,2002 Completed Ti. Hsg. Un.	New (Adj to County) Pop/HU	Initial Pop. Est. July '02 (Col I x Col J)	Initial Pop. Est. July '02 (Adj to Total)
ADAMS COUNTY	348,618	127,299	361,262	132,652	2.72	6,081	138,733	2.69	373,298	372,870
Arvada (MCP)/Hyland	2,847	1,081	2,843	1,092	2.60	11	1,103	2.57	2,834	2,831
Aurora (MCP)	40,249	13,942	41,353	14,446	2.86	346	14,792	2.83	41,788	41,740
Bennett	2,021	732	2,062	753	2.74	51	804	2.70	2,173	2,171
Brighton (MCP)	20,751	6,943	22,146	7,461	2.97	567	8,028	2.93	23,517	23,490
Commerce City	20,991	6,873	22,307	7,278	3.06	800	8,078	3.02	24,434	24,406
Federal Heights	12,065	5,311	11,925	5,311	2.25	0	5,311	2.22	11,769	11,756
Northglenn (MCP)	31,563	12,046	32,822	12,606	2.60	606	13,212	2.57	33,949	33,910
Thornton (MCP)	82,384	29,573	88,434	31,798	2.78	2,381	34,179	2.74	93,810	93,702
Westminster (MCP)	57,419	23,037	58,628	23,648	2.48	568	24,216	2.45	59,249	59,181
Unincorp. Area	78,328	27,761	78,742	28,259	2.79	751	29,010	2.75	79,775	79,683

Table 2B. Evaluation of Estimates, Based on Implied Occupancy/Vacancy Rates (For review)

ADAMS COUNTY

	A	B	C=A-B	D	E=G Top	F=C/D	G=E-F	H=F/E	I	J	K=G/E	L
Name of Municipality	Prel. Pop. Est. July '02	Group Qtr. Pop.	Household Pop.	Persons /Hhld	Total H.U.	Occupied H.U.	Vacant H.U.	Occu. Rate '02	Occu. Rate '00		Vacant Rate '02	Vacant Rate '00
ADAMS COUNTY	372,870	3,362	369,508	2.81	138,733	131,564	7,169	94.83	96.65		5.17	3.35
Arvada (MCP)/Hyland	2,831	0	2,831	2.71	1,103	1,046	57	94.83	97.22		5.17	2.78
Aurora (MCP)	41,740	462	41,278	3.06	14,792	13,489	1,303	91.19	93.08		8.81	6.92
Bennett	2,171	0	2,171	2.83	804	768	36	95.52	97.68		4.48	2.32
Brighton (MCP)	23,490	1,315	22,175	2.91	8,028	7,620	408	94.92	96.14		5.08	3.86
Commerce City	24,406	300	24,106	3.10	8,078	7,776	302	96.26	97.02		3.74	2.98
Federal Heights	11,756	0	11,756	2.35	5,311	4,994	317	94.03	96.50		5.97	3.50
Northglenn (MCP)	33,910	163	33,747	2.71	13,212	12,452	760	94.25	96.34		5.75	3.66
Thornton (MCP)	93,702	550	93,152	2.83	34,179	32,915	1,264	96.30	97.66		3.70	2.34
Westminster (MCP)	59,181	324	58,857	2.55	24,216	23,081	1,135	95.31	97.13		4.69	2.87
Unincorp. Area	79,683	248	79,435	2.90	29,010	27,423	1,587	94.53	97.04		5.47	2.96

Adjustments to the Draft County and Sub-County Population Estimates
Based on Additional Information and Local Review.
This Results in the PRELIMINARY Estimates.

After the initial estimates are calculated, adjustments are made to more accurately reflect the population of sub-county areas where additional information makes that possible. In some instances, for example, small towns or special districts may either do a survey of the population and/or compile detailed data on the number of occupied homes and/or changes in other group quarter populations. Where these efforts produce reasonable results and are accepted by the county and/or neighboring community, their results are entered as the population for the area.

After these adjustments are made, staff sends copies of the draft estimates including Tables 2A and 2B (page 7) to all regions and counties for their review. They are asked again if the housing unit data contained in Table 2A is complete, whether the population estimates themselves look reasonable, and finally, whether the implied occupancy and vacancy rates make sense. Where there appear to be problems or concerns, the staffs of the Demography Section and the local government work together to resolve the problem. This usually includes review of those data that have been used for the particular area and an exploration into other types of data, e.g., utility hookups that might be indicative of changes in the population.

The estimates that are in place after these adjustments are referred to as **preliminary** estimates. It is expected that the preliminary estimates for July 1, 2002 will become available on August 1, 2003.

THE CHALLENGE PROCESS

Adjustments to the Preliminary Population Estimates
Based on Reviews by Local Governments.
This Results in the FINAL Estimates.

Once the preliminary estimates are completed, they are mailed to each county, municipality, and participating park and recreation district for their review. Where any one of these local governmental units has questions regarding the preparation of the estimate and/or are unsatisfied with the actual number, they typically contact the demography staff to attempt to understand and/or work out the problem informally. If from these discussions they believe their area's estimate should be changed, they are required to submit a written "challenge" to the CTF administrator outlining the basis for their proposed adjustment. If staff have agreed to this change, the letter need only be a formal notification of their request. If the local governments are not satisfied with the staff response to their concerns, they may include in the written letter the basis for their disagreement and/or request a meeting with staff to argue their case. The demography staff makes the determination of the final estimate in conjunction with the CTF administrator.

Many times the review leads to questions about the county estimate itself and/or, as is more common,

questions about the determination of the number of housing units by county or by county sub-area. Most often, problems with the local population estimates are resolved by correcting the location of new housing units or determining the effect of a new boundary change. Other times, the focus is on the estimated population for a specific sub-area. It is here, and especially for small municipalities, where people have some perception (if not actual survey) about what their population should be, and thus are ready with an opinion (if not hard data) about how much their population has changed.

Sometimes, the revision of sub-county estimate will lead to a revision in the county estimate. However, more often, the county estimate is viewed as reasonably accurate and thus, (assuming the inventory and assignment of housing units is complete and accurate as well) any upward (or downward) adjustment of one sub-area's population requires some downward (or upward) adjustment elsewhere. If it is not possible to identify an area that may be over- (or under-) estimated, the remaining sub-areas of the county are scaled downward (or upward) proportionally so that the county total remains the same.

Generally, these adjustments can occur and/or the problems with the preliminary estimates can be resolved in an informal manner between local officials and the staff of the Demography Section. If it is a matter of the original data base being incomplete, the additionally required data is developed or retrieved. If it is a matter of a boundary change, then local officials work with staff from the state's Cartography Section to determine the number of housing units that are affected. If it involves a "shifting" of some estimated populations from one (set) of municipality(ies) to another, then the county and/or municipalities or districts affected by the shift are notified and asked to participate in a CTF resolution session.

However, once an attempt has been made to resolve all problems with the preliminary estimates, staff determines the final estimates which are then mailed by the CTF administrator to participating entities. This process must be completed in a timely fashion in order to meet the statutory time-lines in effect for the CTF process. It is expected that the **final** estimates for July 1, 2002 will be released by October 1, 2003.